COAMPS User Support

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LONG-TERM GOALS

The long-term goal of this project is to continue to provide support (e.g., consultation, code updates, training, data transfer, etc.) for those users of the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS®[1]) who obtain the system through the release of the code as determined by release guidelines. The active distribution of COAMPS to the general scientific community cannot be accomplished without support from NRL-Monterey. To fully realize the development potential of the COAMPS system, the Navy must leverage research being performed in the community at large. Through increased usage of COAMPS by the broader community, NRL has been able to leverage discoveries, leading to advances in COAMPS capabilities including aerosol microphysics, numerical methods, and coupled modeling.

OBJECTIVES

One of the primary objectives of this project is to develop and improve our comprehensive technical support capability for the COAMPS users, particularly those who have projects supported by ONR. Components in the support structure include, but are not limited to: improving/updating to the COAMPS web site, updating versions of the code as necessary, updating the COAMPS documentation, providing user feedback to COAMPS developers, providing users with tools to obtain NOGAPS data for COAMPS initial and boundary conditions, observations data (both atmospheric and ocean) for historical cases, and maintaining/updating all of the supporting databases.

APPROACH

We have been updating and maintaining the COAMPS code releases through a two-tiered system as recommended by the COAMPS Process Action Team. Navy funded collaborators have tier 1 access to a recent version of the model and data assimilation system, while researchers and users with no existing Navy funding have tier 2 access, which includes an older version of the COAMPS system and a more generic version of the data assimilation software available upon request. We have been providing support and consultation services to the users through email communications and occasionally hosting on-site visitors who need to have more in-depth knowledge about the COAMPS

[1] COAMPS is the registered trademark of the Naval Research Laboratory.

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system. Furthermore, an on-site training class was conducted in July 2011. We have also begun to work on a new webpage that will provide registered users with step-by-step instructions to download, compile, run, and verify the model. New development and updates to the COAMPS code have also been achieved through leveraging recent research conducted under the COAMPS-TC and Small-Scale projects.

WORK COMPLETED

The following work was completed in FY11 (milestones are italicized):

1. Design and develop a web site to facilitate communications between COAMPS users and also between users and developers. Periodically update the COAMPS documentation

The COAMPS Version 4 (V4) release webpage has been updated with new information about code changes, bug fixes, and new software for obtaining model and observational data. A new website has been created to provide users with step-by-step instructions for using COAMPS.

2. Continue to develop and improve COAMPS functional interoperability with the WRF physics parameterization suite.

We continued with our work incorporating the Thompson microphysics schemes into COAMPS, leveraging efforts in the COAMPS-TC project (ONR sponsored). We now have a new Thompson scheme work in COAMPS-TC and tested for various tropical cyclone cases over both the Atlantic and West Pacific basins. This scheme has also been evaluated for the stratus clouds over the southeast Pacific using observations from the VOCALS[2] field experiment. We are also helping with the work by Tracy Haack (under the Small-scale project) to implement and test various WRF PBL schemes in COAMPS. Jason Nachamkin implemented an updated version of the Kain-Fritsch cumulus parameterization scheme that was originally used in WRF.

3. Establish a series of coherent steps and datasets for COAMPS verification and evaluation.

We implemented a new verification package in the COAMPS V4 system and released this package to the public. This verification code provides users the capability to verify COAMPS forecasts against surface and upper air measurements for individual cases as well as long-term statistics.

4. Organize COAMPS training class

The COAMPS training class was held at NRL, Monterey, from 26-28 July. The training consisted of lectures on COAMPS numerics, dynamics, and physics along with hands-on laboratory sessions. The students also had direct interaction with COAMPS developers during the lab sessions as well as the question/answer session.

[2] VAMOS Ocean-Cloud-Atmosphere-Land Study (VOCALS) – is an international field experiment designed to better understand physical and chemical processes central to the climate system of the Southeast Pacific region.

5. Provide limited consultation to COAMPS users. Provide user feedback to the COAMPS development team. Act as a liaison between the COAMPS developers, the WRF community, and the DTC.

We continue to provide support service and consultation to COAMPS users on a routine basis. We have also provided key advice to other research groups (e.g., University of Oklahoma) on their scientific endeavors using COAMPS. Through our work incorporating and testing WRF physics in COAMPS, we have been sharing bug fixes and new insights with scientists in the WRF community (e.g., Greg Thompson at NCAR; Brad Ferrier at NCEP).

RESULTS

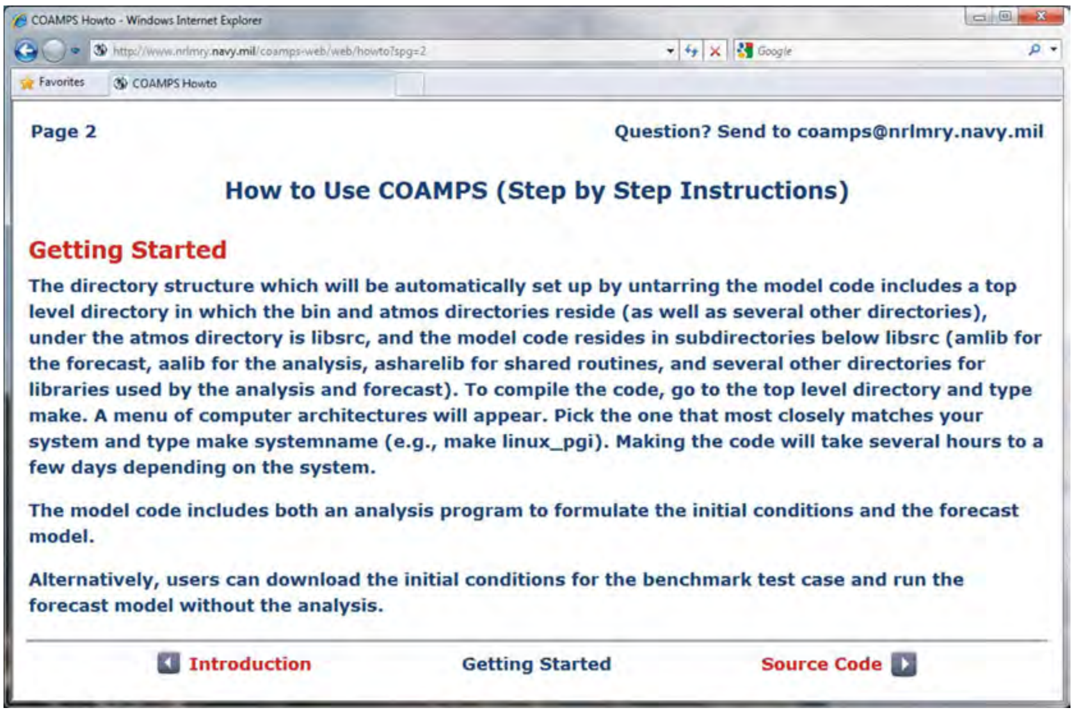

Figure 1. New webpage for step-by-step instructions on using COAMPS and for user-developer interactions.

Figure 1 shows an example of the newly created webpage for step-by-step instructions on how to use COAMPS. Due to security restrictions, instead of setting up a normal user forum where outside users can login to the NRL website for questions and discussions, we adopted a more secure method. Users can follow the instructions at the website and go forward or backward by clicking the arrows at the bottom of the page. If users have questions at any step, they can use the email address provided at the upper right corner to contact NRL for user support. This site is still under development and more detailed features are being added, such as links to code downloads, instructions for code compilation on a range of computer platforms, as well as tips for model execution, and verification.

Leveraging the COAMPS-TC and HFIP projects, we implemented a new microphysics scheme from WRF into COAMPS. This new scheme, the latest Thompson scheme (V3.3), is fundamentally different from many other schemes, in that it is a two moment scheme for ice and rain, but one-moment for cloud water, snow and graupel. The representation of detailed microphysical processes in the scheme incorporates recent findings from field experiments and theoretical studies (Thompson *et al.* 2008). An example of vertical distribution of hydrometeors for COAMPS forecasts of Hurricane Earl (2010) is shown in Fig. 2. While the cloud water and rain distributions are similar between the runs using the COAMPS microphysics scheme (the control run) and the Thompson (V3.3) scheme (the test run), significant differences exist in the distribution of frozen hydrometeors. The upper level ice mixing ratio in the control run has a maximum of 0.2 g kg at the 250 hPa level that is reduced by an order of magnitude in the test run. However snow amounts in the test run are several times higher than that in the control run. The Thompson V3.3 scheme also reduced graupel mixing ratios at the mid levels. These changes in the microphysical structure have impacts on the tropical cyclone structure and intensity based on our tests of a suite of storms.

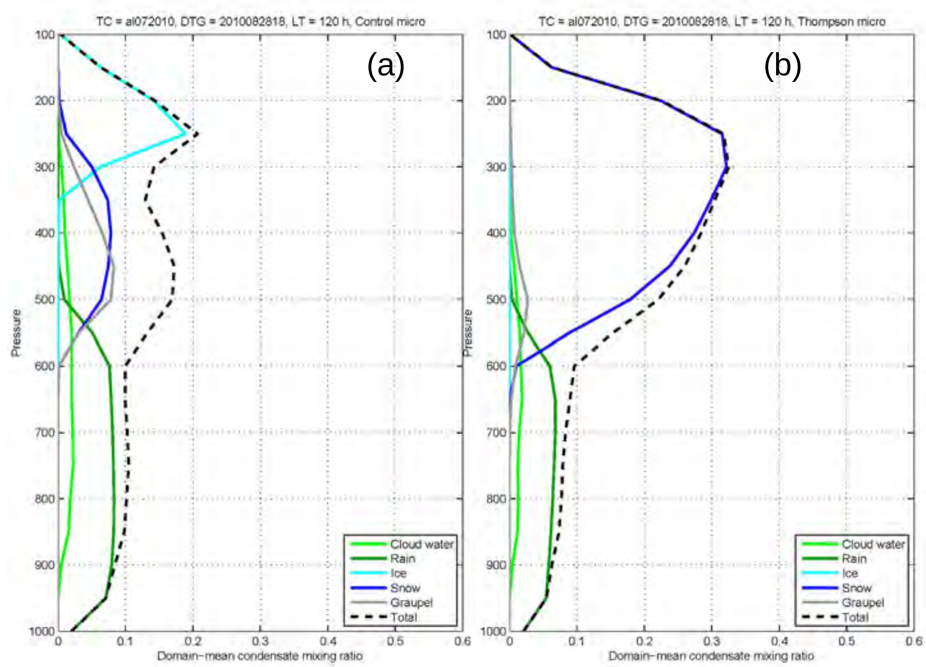

Figure 2. Vertical distribution of domain averaged hydrometeors in the 5-km domain at 120 h of forecast for Hurricane Earl initialized at 1200 UTC 25 August 2010 using the bench COAMPS microphysics scheme (a) and the Thompson V3.3 scheme (b).

It should be mentioned that during this effort, we worked closely with scientists from the WRF community and communicated with them about bugs found in the WRF scheme and the very different microphysical structure of the storm using the different schemes.

To help our users to gain some insight about the COAMPS performance, working with Dr. Jason Nachamkin, we built a streamlined verification/evaluation package and release this package to the

general COAMPS users. This software allows the users to verify COAMPS output against surface and upper air observations. Verification statistics for single event or a period of time can be performed with a just few commands. The complex mathematic operations and display tools embedded in the package can be easily ported to various computer platforms. An application of this software (Fig.3) was demonstrated at the COAMPS training class. The users were encouraged to use this new tool to carefully inspect their results to ensure the model is used correctly.

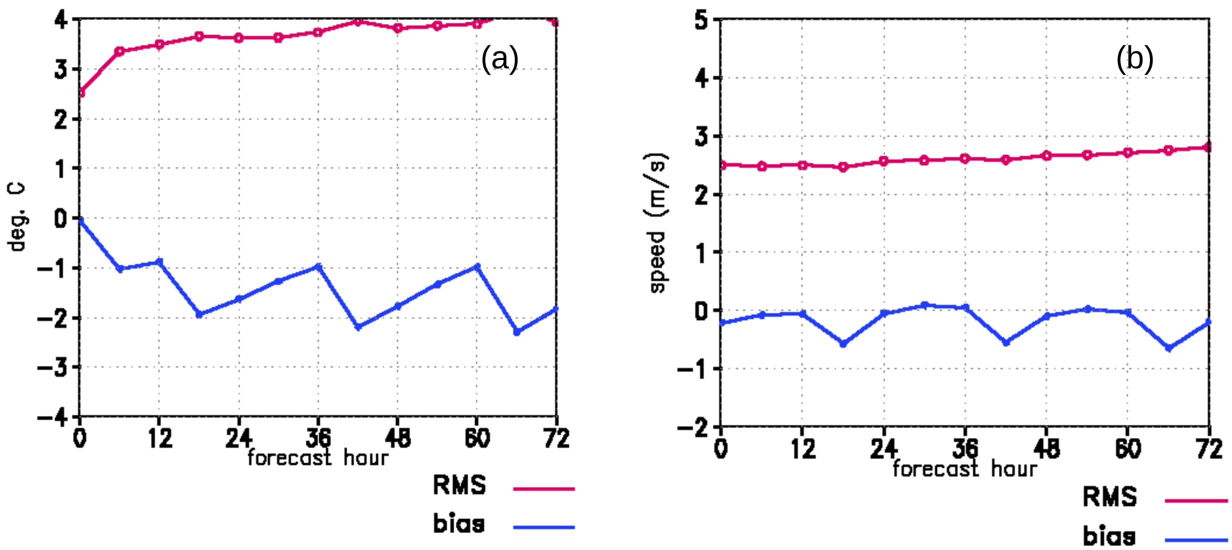

Figure 3. COAMPS performance evaluation of surface temperature (a) and surface wind speed (b) for the month of January of 2010 over the west Atlantic 45-km domain.

Another major activity under this project is the COAMPS training class, which was conducted in July. Significant efforts were invested in planning, preparing the material, communicating with both colleagues and students, and hosting the training sessions. During the 2.5 days of training, lectures were given on the first two mornings and hands-on lab sessions in the two afternoons. A question and answer session was conducted on the third morning. In total 23 students attended the training, some of them new employees at NRL, some from FNMOC, some from universities and research institutions around the world. A survey collected at the end of the training indicated that our students rated the training highly (4.7 out of 5 with 5 being the highest). Positive outcomes from our preparation and presentation of the training include the transition of the verification package to the tier-2 package, as well as a user-friendly software routine for our users to obtain NOGAPS and observational datasets from the GODAE server. Tests of the user code also revealed a bug in the SST analysis routine that was quickly fixed. The COAMPS website was also updated to facilitate communication with users.

IMPACT/APPLICATIONS

The long term benefits from this project are 1) improved opportunities for the best of the next generation of atmospheric researchers to contribute to COAMPS development, 2) increased awareness

and visibility of COAMPS in the broader research community, and 3) accrued credit to NRL and the Navy from academic research carried out using COAMPS. We were somewhat hampered in our efforts to provide this training in that some of the students were not permitted to log into the NRL computers. With the great support of our colleagues on the COAMPS development team, we were able to run the tutoring session efficiently with non-NRL student paired with a NRL scientist or NRL student who has computer access.

TRANSITIONS

All the training materials have been released to the public. The verification software and software for data access have been made available on the website.

RELATED PROJECTS

This project is closely coordinated with the COAMPS-TC RTP jointly supported by ONR and PMW-120 and HFIP project.

REFERENCES

Thompson, G, R. M. Rasmussen, K. Manning, 2008: Explicit Forecasts of winter precipitation using an improved bulk Microphysics scheme. Part II: Implementation of a Snow Parameterization. *Mon. Wea. Rev.*, **136**, 5095–5115.

PUBLICATIONS

None.